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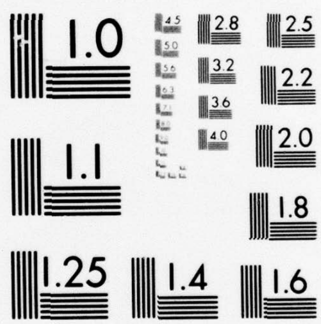

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INFLUENCE OF RELIEF AND ELEVATION OF THE PLACE ON THE MAGNITUDE OF ICE LOADS

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The influence of relief and elevation of the place on the magnitude of the glaze ice load on the cable of standard equipment for measuring ice deposits was arrived at by using the relationship (K_p) between the loads at stations located on mountain slopes and hilltops, and the loads at a station located on a plain on the windward side of the slope. K_p is shown to be a function of the elevation of the place, wind direction relative to the slope during glaze ice formation, elevation of the reference (plain) station, and magnitude of → next page

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the glaze ice load.

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NOTICE

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THE INFLUENCE OF RELIEF AND ELEVATION OF THE PLACE ON THE MAGNITUDE OF ICE LOADS

M. V. Zavarina, L. G. Lomilina

Summary. The influence of relief and elevation of the place on the magnitude of the glaze ice load on the cable of standard equipment for measuring ice deposits was arrived at by using the relationship (K_p) between the loads at stations located on mountain slopes and hilltops, and the loads at a station located on a plain on the windward side of the slope. K_p is shown to be a function of the elevation of the place, wind direction relative to the slope during glaze ice formation, elevation of the reference (plain) station, and magnitude of the glaze ice load.

The size and intensity of glaze ice and rime deposits, and therefore the ice loads on various structures, depend to a great degree on physical and geographic conditions, particularly the relief and elevation of the place. The station network is too scattered to make ice observations in some of the USSR republics, so the influence of the factors mentioned on the magnitude of the ice load cannot be fully considered from these observations.

This influence must be taken into consideration, particularly when compiling large-scale regional maps intended for the use of planning bureaus.

But there are parts of the Soviet Union with dense networks of stations, the observations from which can be used to establish the unknown relationships.

Observations of ice deposits have been made for many years, for example, in the European part of the USSR in the vicinity of 12 ranges of hills with elevations of 250 to 450 m. These stations are located on the plain close to the hills, on slopes, and on hilltops.

Observations made by over 100 stations were used to make a comparative estimate of the magnitude of the ice load as a function of the relief, and of the elevation of the particular place. These observations were synchronized and covered a period of 10 years. The stations were located

at different elevations. The mean of the relationship then was calculated. Here

$$K_P = \frac{P_H}{P_O},$$

where

P_O is the ice load on the cable of standard equipment for measuring ice deposits* at a station on a plain;

P_H is the ice load on the cable of standard equipment for measuring ice deposits at stations on slopes and hills at different elevations.

This relationship then can be used as the conversion factor when converting the ice load found on a plain to that for a place other than on a plain.

The coefficients mentioned depend on the wind direction relative to the range of hills during ice deposit, so were determined separately for the leeward and windward slopes.

Table 1 shows the mean relationship for the windward and leeward slopes of the Donetsk Kryash, the elevation of which is about 350 m, and is included by way of an example.

Table 1

K_P for the Donetsk Kryash

Station No.	1	2	3	4	5	6
H, m	63	114	300	335	174	136
	1.0	1.3	4.6	1.4	0.5	0.4
Relief	plain	windward side			leeward side	

The relationships were calculated for 72 instances of the simultaneous observation of glaze ice and rime deposits at all stations.

The first line indicates the numbers of the stations. These were located on the windward and leeward slopes. The first station was located on a plain on the windward side. Its elevation above sea level was H = 63 m. K_P was taken to be 1 for this place, and the mean value of the ice load on the cable of standard equipment for measuring ice deposits was 30 g/m.

*See explanation in Abh. d. MD der DDR [Proceedings of the Meteorological Service of the GDR], No. 107, Vol. 14, 1973, p. 10.

The table shows that the weight of the ice deposit increases with elevation on the windward slope, but decreases on the leeward slope. The mean value of the ice load close to the top is greater by a factor of 4.6 on the windward side, and greater by a factor of 1.4 on the leeward side. The load decreases with decrease in the elevation of the slope, and finally is smaller than on the plain on the windward side. The load at station 6 was only 40% of the load at station 1, despite the fact that station 6, which was on the leeward slope, was at an elevation above sea level twice that of station 1.

The mean K_p at an elevation of 100 m was found graphically, and was 2 for the corresponding hill, being greater for the lower part of the slope (K_p = 1.3 at an elevation of 50 m) and decreasing with increase in elevation.

K_p depends on differences in elevations above sea level, as well as on the elevation of the reference station (plain station). This is evident from the example of the Yergeni Hills, where the elevation of the reference station is 7 m, and the mean value of K_p is 0.6 at 100 m, as well as from the example of the Valday, where the reference station is 196 m above mean sea level, and K_p = 1.5.

At the same time, K_p is very much dependent on the weight of the deposit at the reference station. This is confirmed in Table 2, which lists the results of calculating K_p using different reference station ice load values.

Table 2

K_p as a Function of the Magnitude of the Ice Load (P_0) on Standard Equipment for Measuring Ice Deposits at a Reference Station

Hill	H, m	ΔH	P_0, g/m: 10			11 to 20			21 to 40			> 40		
			P_0	n	K_p	P_0	n	K_p	P_0	n	K_p	P_0	n	K_p
Yergeni	-7	185	4.1	19	18.4	17	14	3.5	26	12	2.4	112	3	2.2
Novogrudskaya	170	93	7.5	25	5.5	16	22	3.1	27	19	1.6	108	17	1.1

In this table, H is the elevation of the station above mean sea level (in meters), ΔH is the difference in the elevations of two stations located on the windward slope, $\bar{P}$ is the mean value of the ice load determined for each class of P_0 at the reference station (plain station), n is the number of observations, and K_p is calculated for an elevation of 100 m.

This table shows the heavy influence the magnitude of the load has on K_p. This ratio can be very high for P_0 values that do not exceed 10 g/m; it is less than 3 for $P_0 > 40$ g. A decrease in the load with increase in elevation was noted for the Novogrudskaya Uplands for values of $P_0 > 100$ g/m.

The table also shows the influence elevation of the reference station has on K_p. The K_p for the first hill, which is not as high as the second, is greater.

The studies revealed that the magnitude of K_p can increase greatly with elevation (by a factor greater than 10 at an elevation of 100 m) when ice loads are small. Further, the conversion factor for the deposit weight, K_p, depends on the elevation of the place (and, therefore, on wind speed), as well as on wind direction. The ice load is smaller on the leeward slopes than it is on the plain.

The magnitude of the ice load, and the elevation of the reference station (plain station) greatly influence K_p, because reference to the station is the basis for the determination of K_p.

Thus, K_p is the function $K_p = f(H_0 P_0 \Delta H, d)$, where d is the wind direction when ice deposits are forming.

Additional observations must be processed in order to arrive at a better understanding of the influence relief and elevation of a place have on the magnitude of the ice load.

The results must be generalized theoretically, and the most important factors that influence the magnitude of K_p must be established.